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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/615,042	07/08/2003	Valeriy Sukharev	03-0509	3892
24319	7590	10/06/2005	EXAMINER	
LSI LOGIC CORPORATION 1621 BARBER LANE MS: D-106 MILPITAS, CA 95035			FENTY, JESSE A	
			ART UNIT	PAPER NUMBER
			2815	

DATE MAILED: 10/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/615,042	Applicant(s) SUKHAREV ET AL.	
	Examiner Jesse A. Fenty	Art Unit 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 July 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-7 rejected under 35 U.S.C. 103(a) as being unpatentable over Farrar (US 2004/0169213 A1).

In re claims 1, 3 and 6, Farrar (esp. Figs. 2K, 3D) disclose a semiconductor device and method of forming the same comprising:

metal deposits (207);

an intermediate liner layer (314) comprising tantalum nitride; and

an interconnect liner layer (216) comprising aluminum-copper alloy in the range of 0.5% copper section [0046], lines (25-29), wherein the interconnect liner layer is a permanent component of the interconnect and does not interact with the copper deposit to form an alloy at any time while the method is performed; and

an upper copper layer (136).

Farrar does not expressly disclose the lower deposit comprising copper. It would have been obvious for one skilled in the art at the time of the invention to use copper instead of the disclosed tungsten because copper is a well known conductor to enhance the conductivity of an interconnect structure such as this.

In re claim 2, 4, and 7, Farrar discloses the methods and device of claims 1, 3, and 6 respectively, but does not expressly disclose the deposition being done using the PVD technique. However, such as technique is disclosed by Applicant in the specification to be a "conventional" technique and thus would have been obvious for one of ordinary skill the art at the time of the invention to employ to fabricate the structure.

In re claim 5, Farrar discloses the method of claim 3, wherein the intermediate liner layer comprises Ta/TaN.

3. Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu (U.S. Patent No. 6,334,349 B2).

In re claims 1, 3 and 6, Hsu (esp. Figs. 2A-2C) disclose a semiconductor device and method of forming the same comprising:

copper deposits (200; column 5, line 35);

an intermediate liner layer (205) comprising tantalum nitride (column 10, line 50);

and

an interconnect liner layer (220) comprising aluminum-copper alloy (column 10, line 34), wherein the interconnect liner layer is a permanent component of the interconnect and does not interact with the copper deposit to form an alloy at any time while the method is performed; and

an upper copper layer (column 5, lines 53-55),

wherein the interconnect liner layer is a permanent component of the interconnect and does not interact with the copper or copper deposit to form an alloy at any time while the method is performed (as a result of the presence of the TaN layer as described in Applicant's specification.)

Hsu does not expressly disclose the use of CMP, but does disclose the upper layer having a degree of planarity (column 5, lines 18-19). CMP is a well-known method of forming planar layers in the art and it would have been obvious for one skilled in the art at the time of the invention to use such a process, for the purpose, for example, of producing more uniform devices.

In re claim 2, 4, and 7, Farrar discloses the methods and device of claims 1, 3, and 6 respectively, wherein the deposition method is PVD (column 6, lines 22-37). Additionally, such a technique is disclosed by Applicant in the specification to be a "conventional" technique and thus would have been obvious for one of ordinary skill the art at the time of the invention to employ to fabricate the structure.

In re claim 5, Farrar discloses the method of claim 3, wherein the intermediate liner layer comprises Ta/TaN.

Response to Arguments

4. Applicant's arguments, see Appeal Brief, pages 5-12, filed 07/21/05, with respect to claims 1-7 have been fully considered and are persuasive. The Final Rejection of 02/08/05 has been withdrawn.

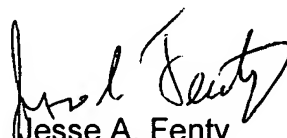
5. Applicant's arguments with respect to claims 1-7 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jesse A. Fenty whose telephone number is 571-272-1729. The examiner can normally be reached on 5/4-9 1st Fri. Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 571-272-1664. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Jesse A. Fenty
Examiner
Art Unit 2815